

High Current DC Negative Ion Sources for Cyclotron

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Filament driven multi-cusp negative ion sources have been developed for proton cyclotrons in medical applications. In Cs-free operation, H^- beam of 10 mA and D^- beam of 3.3 mA were obtained stably at an arc power of 3 kW and 2.4 kW respectively. The maximum H^- current reached 15 mA at an arc power of 6.6 kW by increasing the magnetic filter field without Cs. In Cs-seeded operation, H^- beam of 16 mA was obtained at a lower arc power of 2.8 kW with less electron current accompanied [1]. Further enhancement of the beam current is demanded for many applications of cyclotron, such as cancer therapy and medical radioisotope production. In order to increase H^- beam current up to 20 mA, some improvements of the source are in progress. The relationship between H^- production and the magnetic filter field has been investigated by beam measurements, plasma diagnostics, and numerical analysis with KEIO-MARC code [2] for different magnetic filter field strengths. The Cs-seeded operation has been tested with a plasma electrode made of molybdenum to optimize the plasma electrode temperature for H^- production. The shape and the diameter of tungsten filaments have been optimized to extend their lifetime. In this paper, the results of these improvements are presented.

References

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